

words, the lamp fan 147 draws fresh air and causes wind to blow against the lamp reflector opening portion 214. Thus, an air flow can be positively produced in the region surrounded by the reflection surface of the lamp reflector 157.

Thus, by decreasing the surface temperature of the quartz glass of the lighting tube 156° to 900° C. or below, the phenomenon where only the upper portion becomes opaque can be prevented. As a result, the differences of brightness and temperatures at upper and lower portions of the lighting tube 156 can be reduced. In addition, when the temperature of the front sealed portion 156a is decreased to 300° C. or below, the air insulation can be maintained for a long time. Thus, the life of the lighting unit can be prolonged.

Thus, as the above-mentioned cooling means, by disposing another lamp fan at a position adjacent to the reflector opening portion, air flows effectively take place on the surface of the lighting tube and in the front sealed portion in the region surrounded by the reflection surface of the lamp reflector. Therefore, the surface temperature of the quartz glass can be cooled to a required temperature or below. As a result, the phenomenon where part of the quartz glass becomes opaque does not take place. Consequently, the optical properties such as brightness and color temperatures can be stabilized. In addition, when the temperature of the front sealed portion is decreased to the required temperature or below, the air insulation of the metal halide lamp can be maintained for a long time and thereby the life thereof can be prolonged. When this lighting unit is used in the liquid crystal color projector, projected pictures which are free of uneven intensity of illumination and uneven colors can be accomplished. Moreover, in comparison with the related art, a metal halide lamp with a long life can be obtained.

#### INDUSTRIAL UTILIZATION

The present invention is suitable for a projection type liquid crystal video projector which is small in size and light in weight, free of uneven colors and deviation of pixels, and has high brightness and high magnification.

What is claimed is:

1. A projector-type liquid crystal projector comprising a light source; a plurality of color separating means for separating light emitted by said light source into beams of blue, green and red colors; optical means including image forming liquid crystal light valves and image synthesizing means for synthesizing images for the respective blue, green and red beams which are arranged in an optical path; and a projection lens,

0036623-072899

CM

said color separating means, said image forming liquid crystal light valves, and said image synthesizing means being secured to a top surface of a box-shaped lower chassis by fixing members.

an outer case being secured to side surfaces of said lower chassis separate from said top surface.

2. A projector-type liquid crystal projector comprising a light source, a plurality of color separating means for separating light emitted by said light source into beams of blue, green and red colors; optical means including image forming liquid crystal light valves and image synthesizing means for synthesizing images for the respective blue, green and red beams which are arranged in an optical path; and a projection lens.

a cooling [fans] fan being positioned in a plane [over] below a surface on which said image forming liquid crystal light valves are secured, said image forming liquid crystal light valves being operatively associated with said cooling [fans] fan by being positioned directly in the path of cooling air produced by said cooling [fans] fan.

3. A projector-type liquid crystal projector comprising a light source; a plurality of color separating means for separating light emitted by said light source into beams of blue, green and red colors; optical means including image forming liquid crystal light valves and image synthesizing means for synthesizing images for the respective blue, green and red beams which are arranged in an optical path; and a projection lens.

said light source including a light tube and a lamp reflector housed in a lamp housing;

an exhaust fan being arranged near one side surface of the lamp housing to cover one side surface of the lamp housing and exhaust air at said one side surface.

a hole for air suction and exhaust being formed in a second side surface of said housing opposed to said one side surface of said housing.

a lamp fan being positioned further forward than an opening of the lamp reflector and laterally of the lamp housing.

4. A projector as claimed in claim 3, further comprising an air regulating plate for controlling air flow to the light tube, said air regulating plate being disposed in the path of flowing air of said lamp fan.

\* \* \* \* \*

*Sub  
B'*

I 171 173 -

171 173

171 173

I  
L

09362623-072899

5. A projector comprising:

a light source;

separation optical elements that separate light emitted by the light source into beams of blue, green and red colors;

liquid crystal light panels that modulate respective ones of the blue, green and red beams separated by the separation optical elements;

a synthesizing optical system that synthesizes the blue, green and red beams modulated by the light panels;

a projection lens that receives the synthesized modulated light from the synthesizing optical system;

a chassis having a first wall and at least one second wall that extends substantially perpendicular to the first wall, the separation optical elements, the light panels and the synthesizing optical system secured so as to be constrained against movement relative to the first wall; and

an outer case attached to the at least one second wall of the chassis.

6. A projector as claimed in claim 5, further comprising a plurality of said second walls.

7. A projector as claimed in claim 6, wherein the first wall and the plurality of second walls form an enclosure.

8. A projector as claimed in claim 5, wherein the at least one second wall includes a projection that extends substantially parallel to the first wall, the projection having a hole.

9. A projector as claimed in claim 8, wherein the outer case is attached to the chassis via the hole.

10. A projector as claimed in claim 9, further comprising a screw that attaches the outer case to the chassis via the hole.

11. A projector as claimed in claim 5, wherein the separation optical elements include two dichroic mirrors.

12. A projector as claimed in claim 5, wherein the synthesizing optical system includes two dichroic surfaces.

668270-22929560

I

13. A projector as claimed in claim 5, wherein the synthesizing optical system includes two dichroic layers.

14. A projector comprising:

a light source;

separation optical elements that separate light emitted by the light source into beams of blue, green and red colors;

liquid crystal light panels that modulate respective ones of the blue, green and red beams separated by the separation optical elements;

a synthesizing optical system that synthesizes the blue, green and red beams modulated by the light panels;

a projection lens that receives the synthesized modulated light from the synthesizing optical system; and

a cooling fan positioned in a plane below a surface on which said liquid crystal light panels are secured, said liquid crystal light panels being operatively associated with said cooling fan by being positioned directly in the path of cooling air produced by said cooling fan.

15. A projector as claimed in claim 14, wherein the separation optical elements include two dichroic mirrors.

16. A projector as claimed in claim 14, wherein the synthesizing optical system includes two dichroic surfaces.

17. A projector as claimed in claim 14, wherein the synthesizing optical system includes two dichroic layers.

18. A projector as claimed in claim 14, further comprising an air deflector arranged to direct the air from the cooling fan toward the liquid crystal panels so as to define the path of cooling air.

19. A projector comprising:

a light source including a light tube and a lamp reflector housed in a lamp housing;

separation optical elements that separate light emitted by the light source into beams of blue, green and red colors;

Sub  
C' B

09362623-07899

liquid crystal light panels that modulate respective ones of the blue, green and red beams separated by the separation optical elements;

a synthesizing optical system that synthesizes the blue, green and red beams modulated by the light panels;

a projection lens that receives the synthesized modulated light from the synthesizing optical system;

an exhaust fan arranged near one side surface of the lamp housing to cover one side surface of the lamp housing and exhaust air at one side surface;

a hole for air suction and exhaust formed in a second side surface of said lamp housing opposed to said one side surface of said lamp housing; and

a lamp fan positioned further forward than an opening of the lamp reflector and laterally of the lamp housing.

20. A projector as claimed in claim 19, further comprising an air regulating plate that controls air flow to the light tube, said air regulating plate disposed in the path of flowing air of said lamp fan.

21. A projector as claimed in claim 19, wherein the separation optical elements include two dichroic mirrors.

22. A projector as claimed in claim 19, wherein the synthesizing optical system includes two dichroic surfaces.

23. A projector as claimed in claim 19, wherein the synthesizing optical system includes two dichroic layers.

24. A projector as claimed in claim 2, further comprising an air deflector arranged to direct the air from the cooling fan toward the liquid crystal valves so as to define the path of cooling air.

09362623.072899